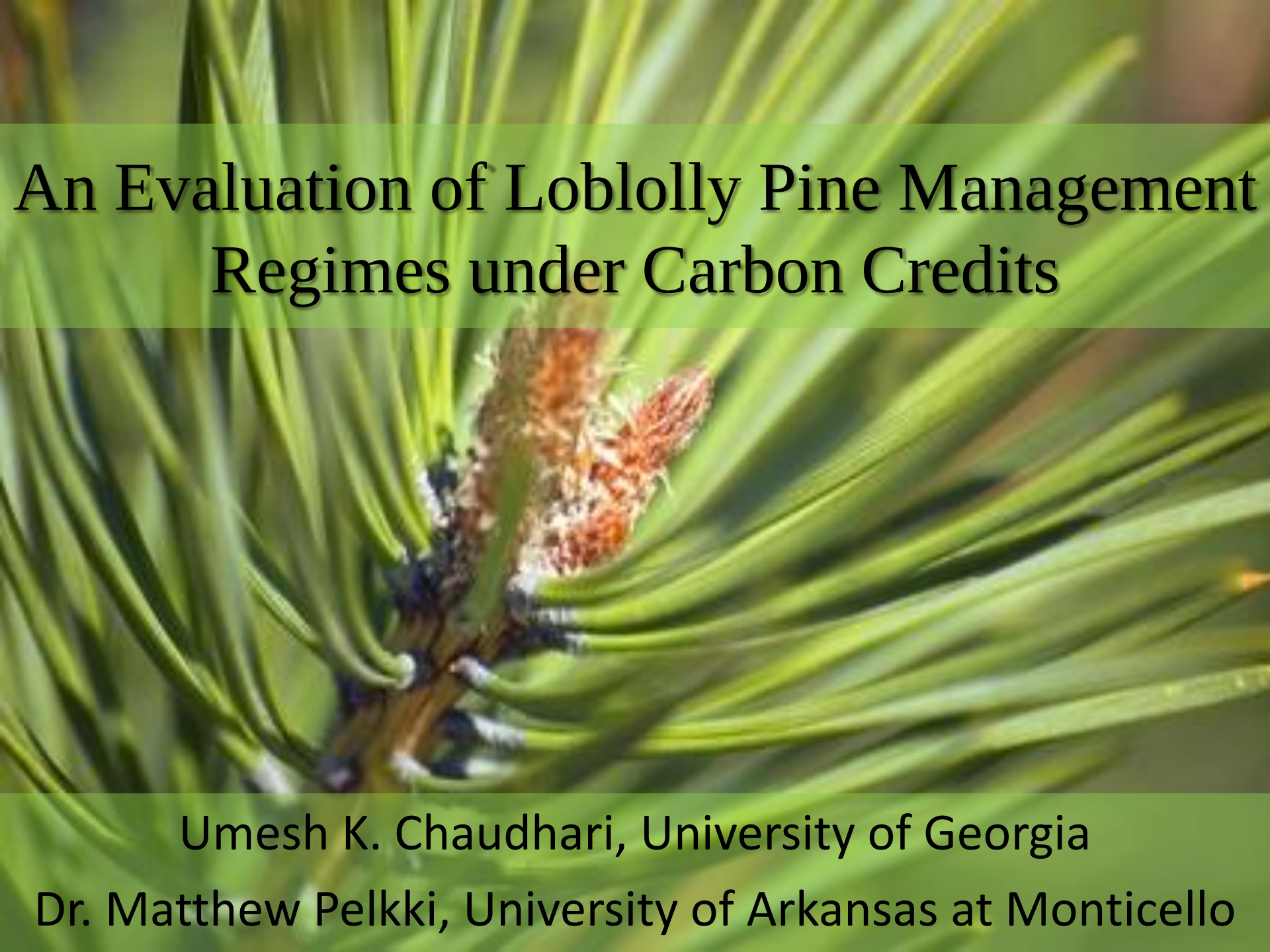


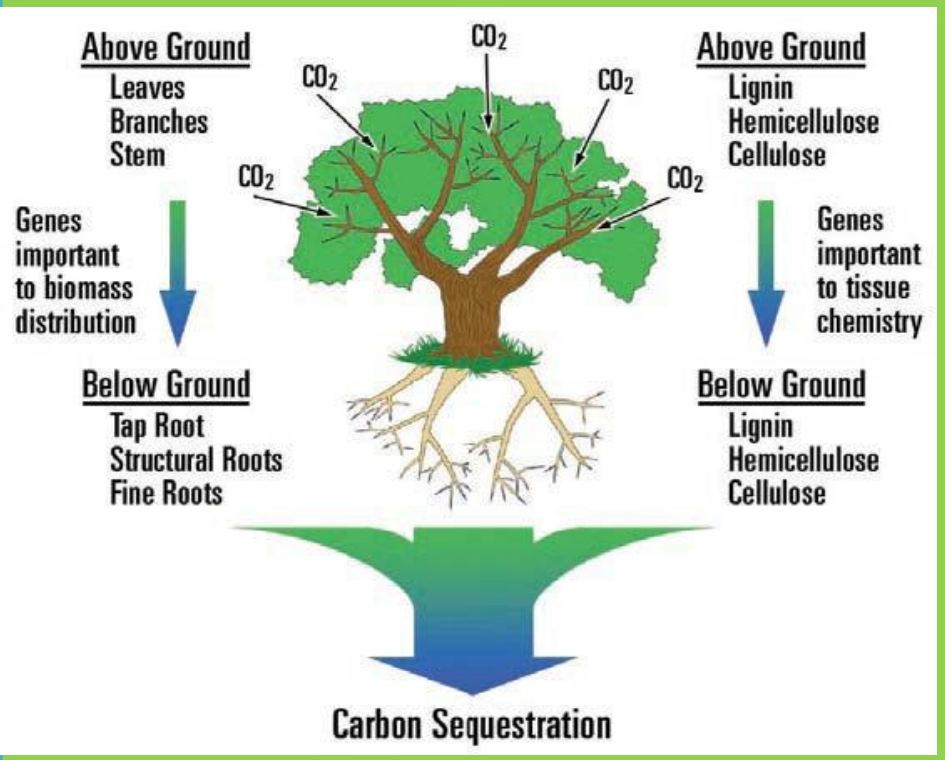
An Evaluation of Loblolly Pine Management Regimes under Carbon Credits

Umesh K. Chaudhari, University of Georgia

Dr. Matthew Pelkki, University of Arkansas at Monticello

Introduction

Forest carbon sequestration is the process of capturing atmospheric carbon dioxide in living trees (or wood products).



Carbon Payment as a Credit

- A “carbon credit” is a tradable instrument which equals to ~1 Mt of CO_2e emission reduction.
- Large polluters have to buy carbon offset credits from “carbon markets” to emit beyond their allotted quota (cap).
- Local aggregators (individual or firm) buy and collect offset credits from landowners and sell it to the carbon markets like RGGI and CAR.
- Landowners get paid and polluters are allowed to buy or sell credits to stay at or below their designated cap.

Justification

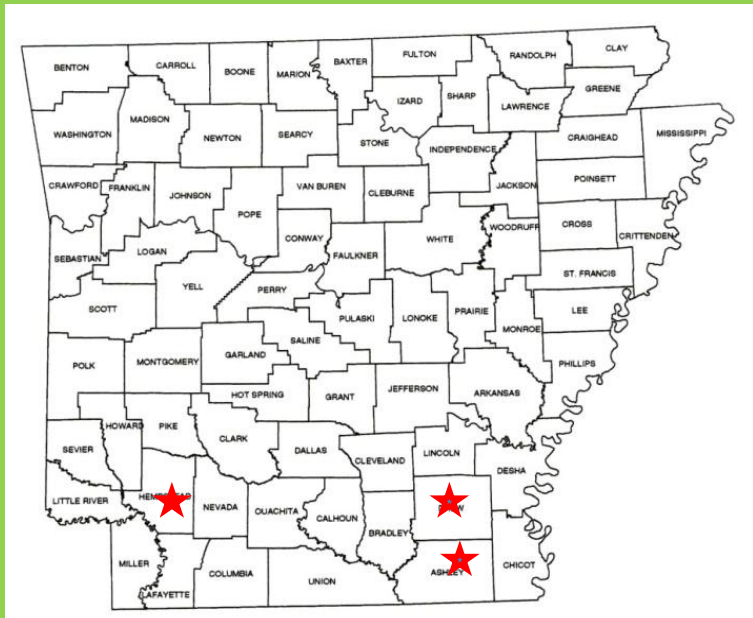
- Environmental concern due to climate change.
- Loblolly pine carbon sequestration in a stand level in different management regimes is poorly known.
- Financial trade-offs among management regimes in given carbon trading rules.
- Studies mainly in one particular management regimes.

Objectives

- Compare carbon sequestration (herein CO_2 sequestration) among different management regimes.
- Apply prices to traditional wood commodities and carbon to evaluate net returns.
- Conduct sensitivity analysis to carbon market prices and interest rates.

Study design

- NATURAL EVEN-AGED
  - Thinnings at age 37, 42, and 47 years
  - Final harvest at age 52
- UNEVEN-AGED
  - 30-year history
  - Seven cutting cycles
- PLANTATION
  - Thinnings at age 12 and 18
  - Final harvest at age 25



Ecological Consideration

- Live tree biomass
  - Above ground
  - Below ground
- Allometric equations
- 53.1% is C in dry biomass (Birdsey 1992)
- Wood biomass and CO_2 in Mg/ha or Mg/ha/yr
- Long lived wood product (LLWP) factors from CCX forestry protocol (CCX 2009)

Economic Consideration

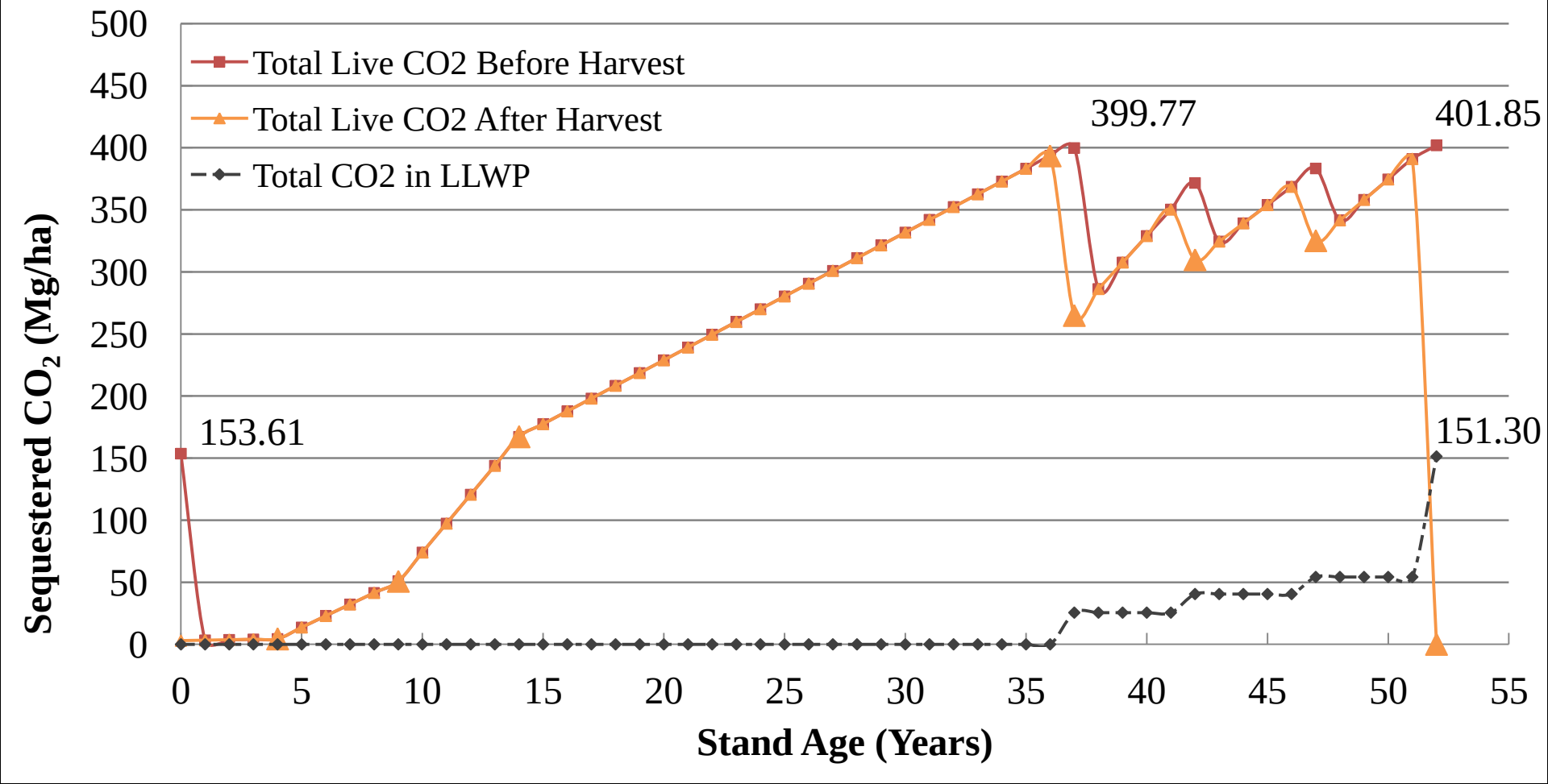
- Timber prices (TMS 3rd quarter, 2010):
  - Sawtimber price: $ 33 metric ton
  - Pulpwood price: $ 10 metric ton
- Interest rate of 6% (base).
- CO_2 price of $4 per metric ton (base).
- CO_2 price of $4, $8, $12, and $20 and $ at 4% , 6%, 8%, and 10% of ARR (Sensitivity analysis).
- Returns of timber, Live CO_2, and LLWP in NPV and SEV.

Trading Rules – what carbon can a forest landowner *really* sell?

- Additionality
- Pool allowed
- Reserve or buffer pool for insurance
- Length of carbon contract
- Transaction costs
- Leakage

Results - Even-aged

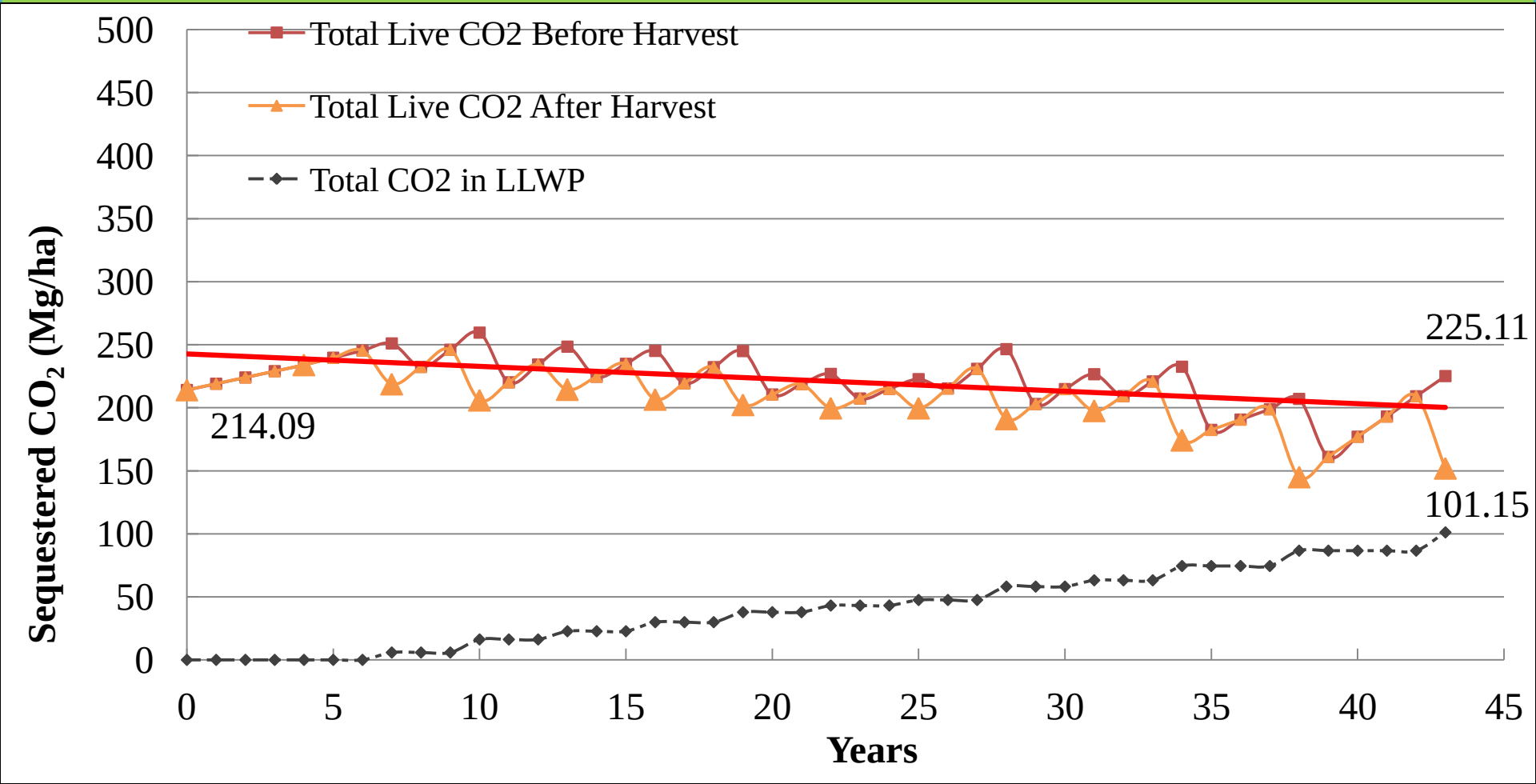
CO_2 sequestration in natural even-aged loblolly pine Stand 639 of Crossett Experimental Forest, Crossett, AR



Uneven-aged:

CO_2 sequestration with lower residual growing stock

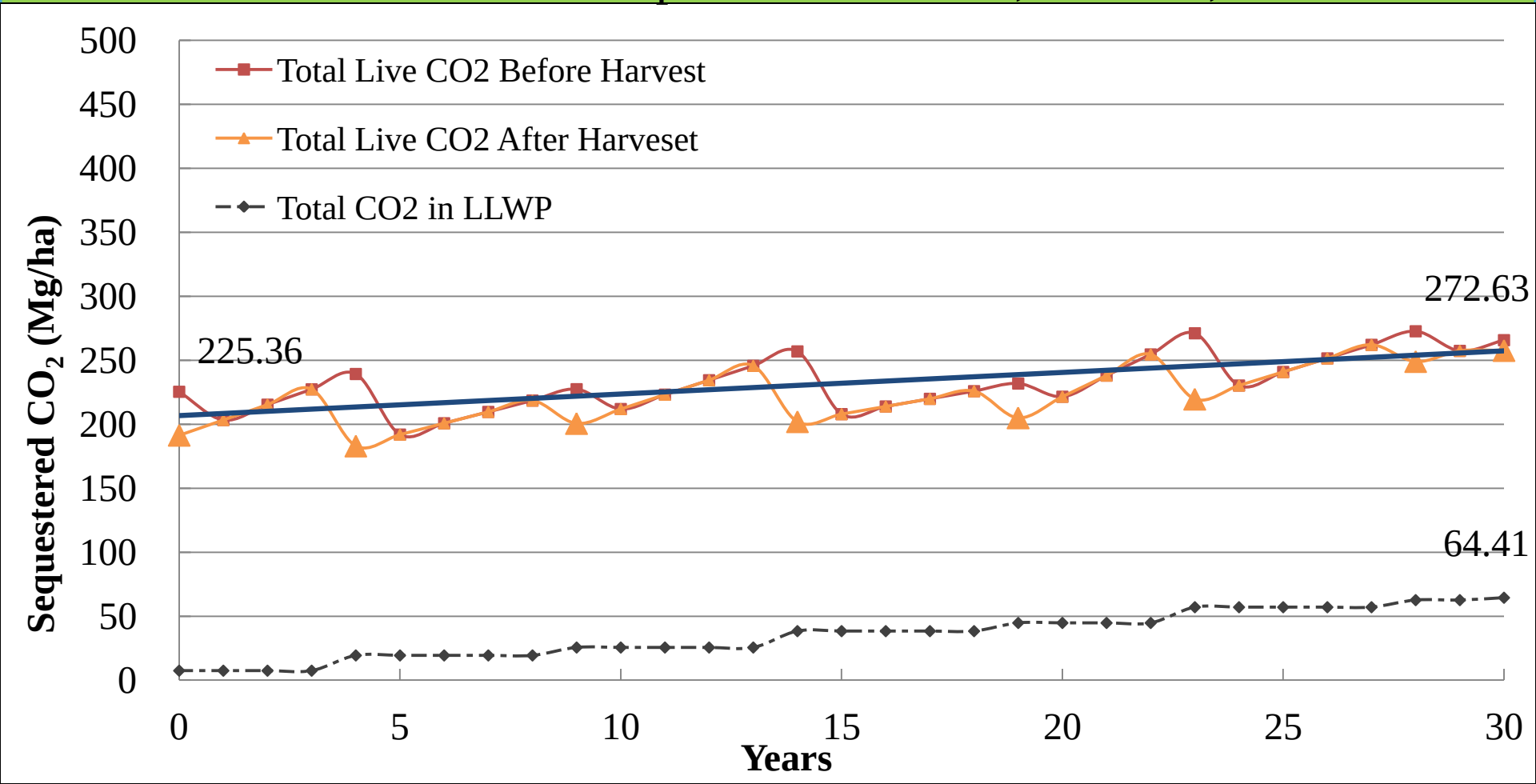
CO_2 sequestration in natural uneven-aged loblolly pine stand in Hope, AR



Uneven-aged:

CO_2 sequestration with higher residual growing stock

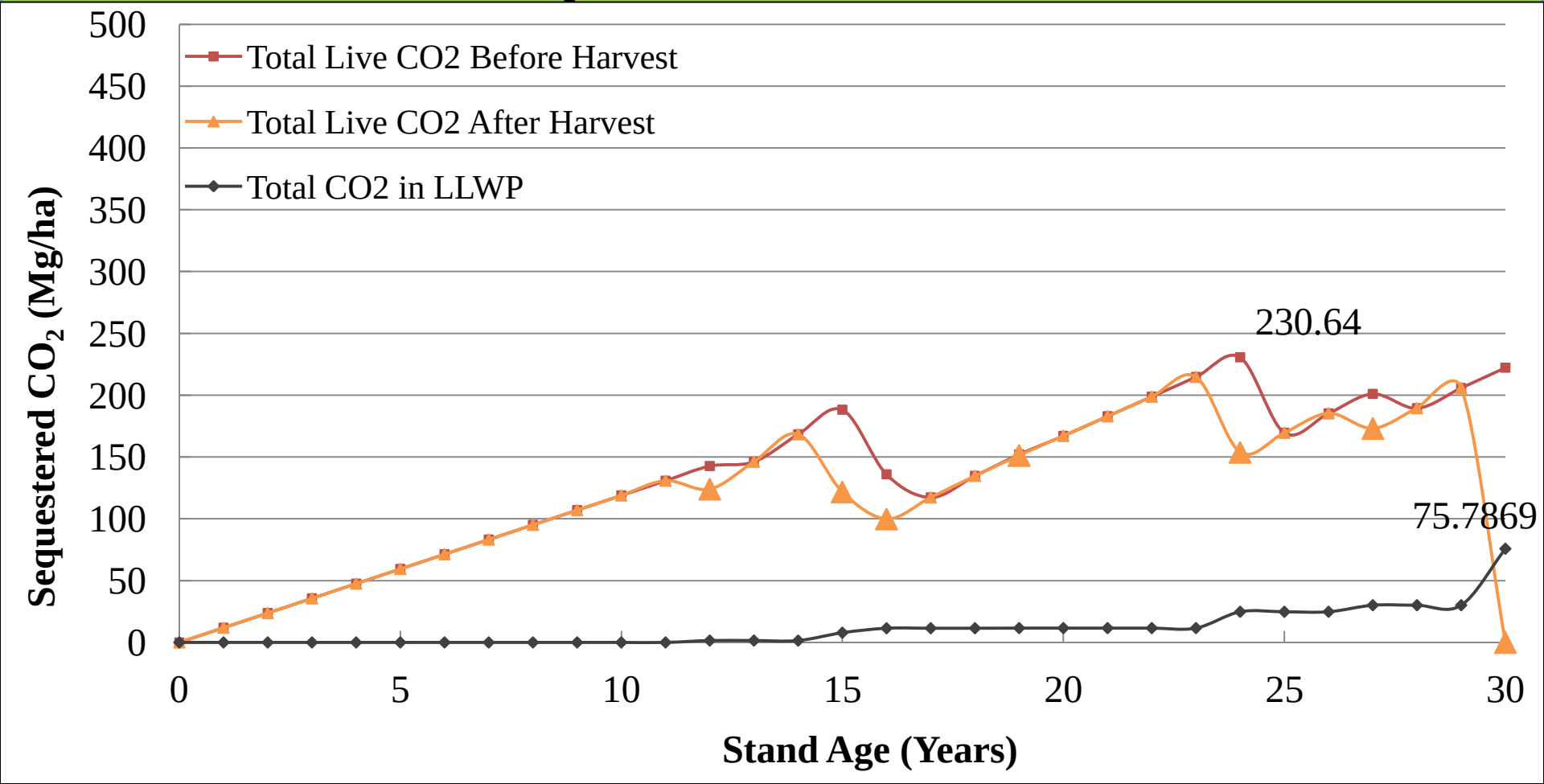
CO_2 sequestration in natural uneven-aged loblolly pine in Good Forty Stand of Crossett Experimental Forest, Crossett, AR



Plantation:

CO_2 sequestration in operational plantation

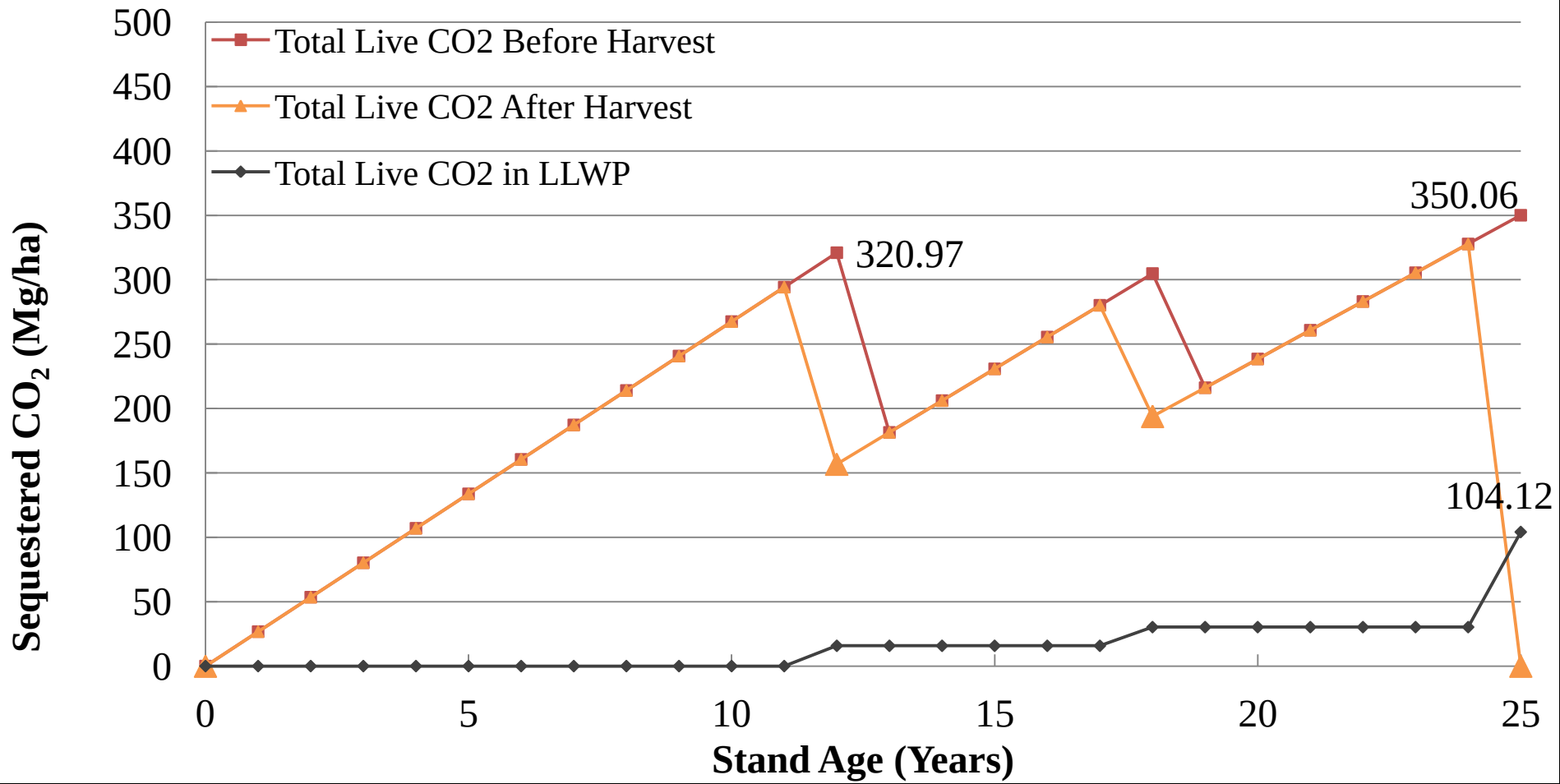
CO_2 sequestration in operational loblolly pine plantation in UAM Experimental Forests, AR



Plantation:

CO_2 sequestration in intensive plantation

CO_2 sequestration in Intensive loblolly pine plantation in Monticello, AR



Returns from Natural Even- Aged Loblolly Pine, Crossett, AR

Timber Value

- 52-year rotation
- 421 Mg/ha sawtimber
- 48 Mg/ha pulpwood
- NPV of $930/ha
- SEV of $977/ha

Carbon Contract (15-Year) Value

Starting point in Carbon Contract	NPV of CO_2 W/O LLWP	NPV of CO_2 W/ LLWP
1st	$281	$281
2nd	$273	$273
3rd	$265	$265
10th	$128	$128
18th	$69	$69
19th	$11	$23
33rd	($26)	($6)
34th (final)	($39)	($12)

22 out of 34, 15-year contract had positive NPV.

Returns from Natural Uneven- Aged Loblolly Pine (Good Forty), Crossett, AR

Timber Value

- 30 years = 7 cutting cycles
- 157 Mg/ha of sawtimber
- 19 Mg/ha of pulpwood
- NPV of $343/ha per CC
- SEV (incl. RGS) of $2,714/ha/cc
- SEV (excl. RGS) of $930/ha/cc

Carbon Contract (15-Year) Value

Starting point in Carbon Contract	NPV of CO_2 W/O LLWP	NPV of CO_2 W/ LLWP
1st	($32)	$43
2nd	($36)	$39
3rd	($32)	$14
5th	($20)	$26
9th	$17.28	$61
12th	($8)	$51
13th	$25	$51
14th (final)	$25	$52

6 out of 14, 15-year contracts had positive NPV.

Returns from Intensive Loblolly Pine Plantation, Monticello, AR

Timber Value

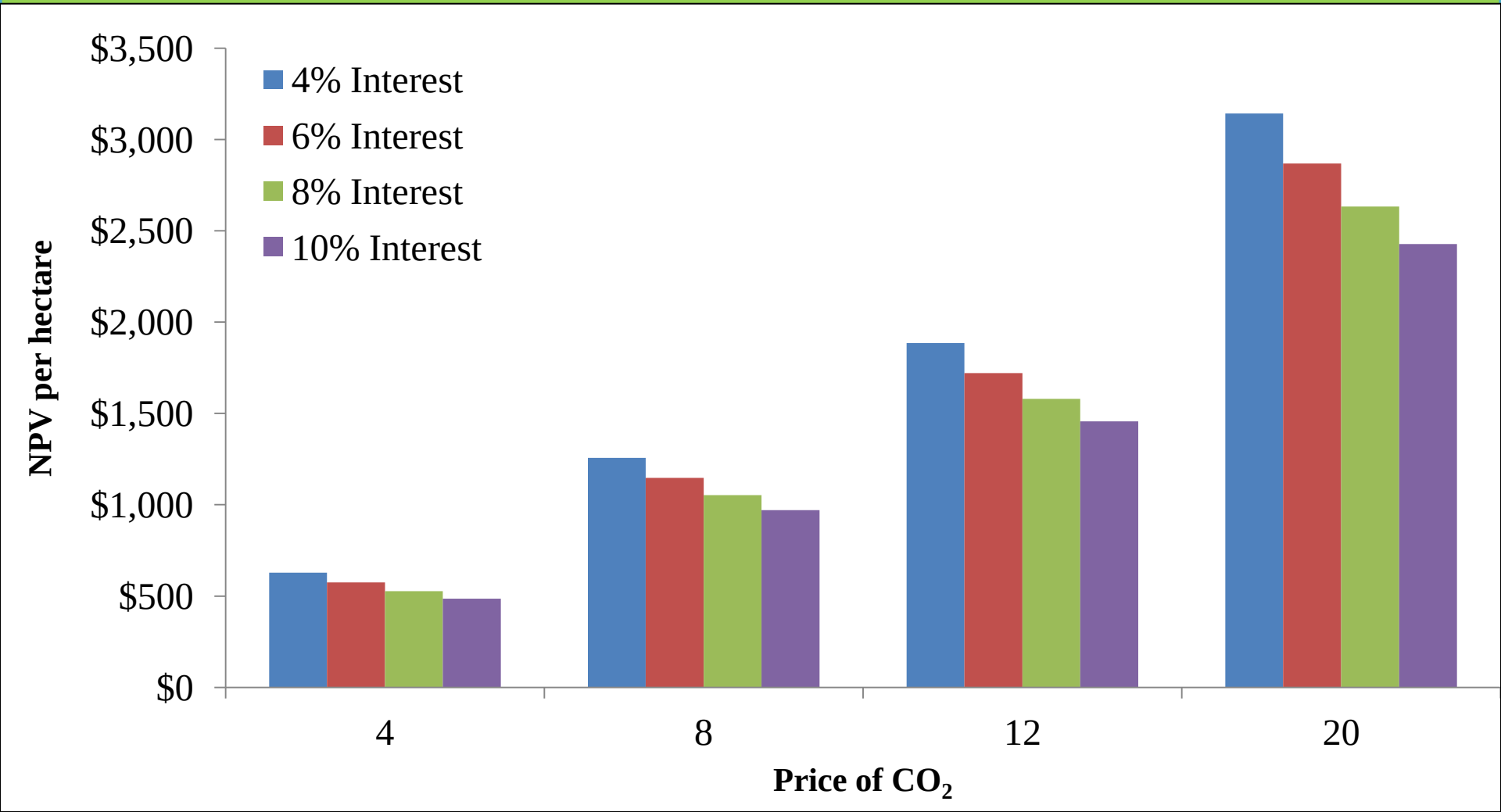
- 25 Year rotation
- 240 Mg/ha of sawtimber
- 172 Mg/ha of pulpwood
- NPV of $1,412 /ha
- SEV of $1,841 /ha

Carbon Contract (15-Year) Value

Starting point in Carbon Contract	NPV of CO_2 W/O LLWP	NPV of CO_2 W/LLWP
1st	$574	$605
2nd	$523	$555
3rd	$476	507
5th	$257	$308
7th	$175	$226
9th	$102	154
10th	$69	$120
11th	($234)	($114)

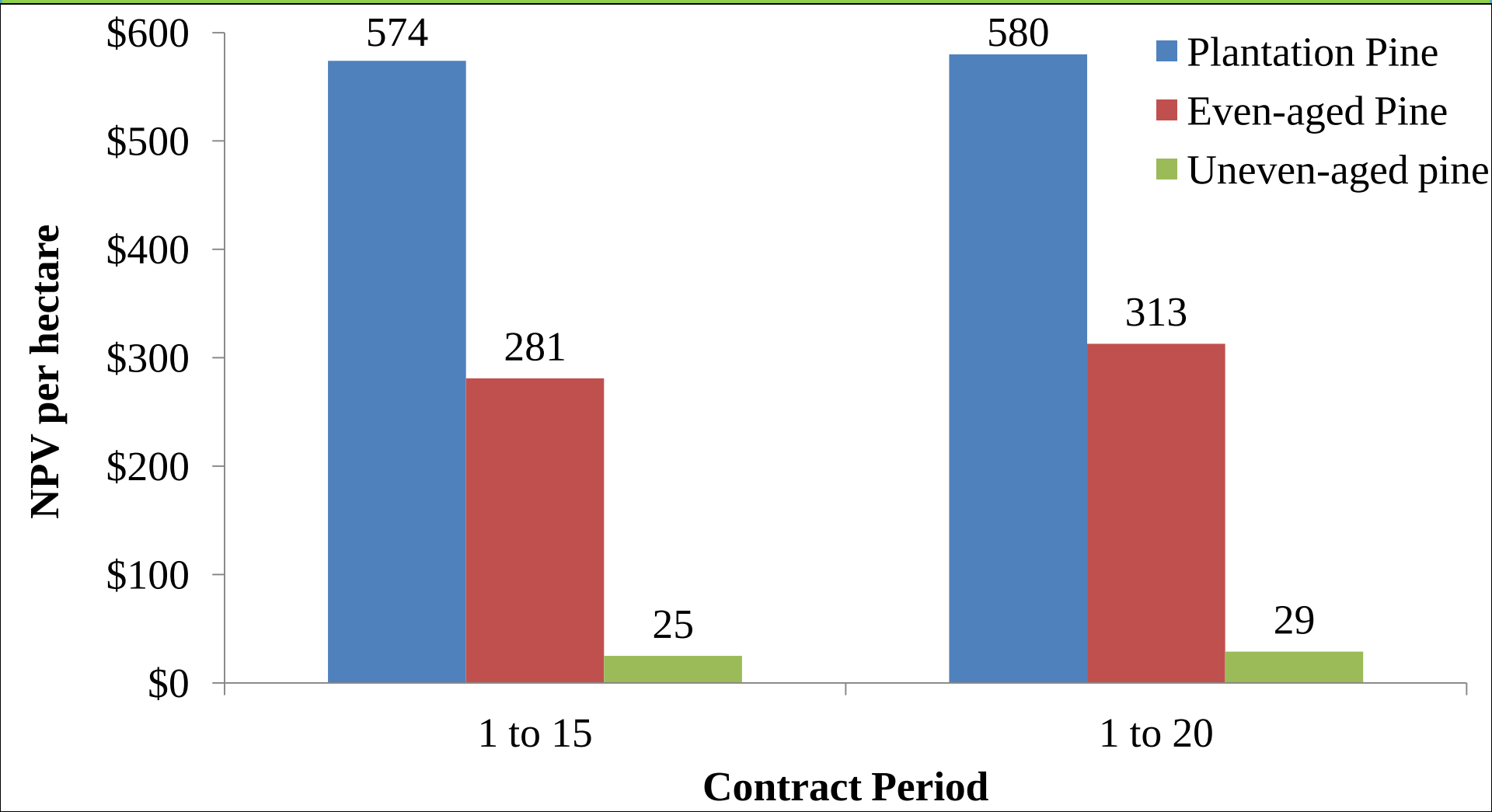
10 out of 11, 15-year contracts had positive NPV.

Sensitivity to interest rates and CO_2 prices in a 15-year intensive pine plantation stand



Sensitivity to length of the contract

NPV amount at \$4 CO_2 price and 6% Interest (Highest positive contract values)



Conclusion

- Carbon sequestration was faster and financial return were higher in plantation pine than any other management regimes.
- However, additionality rule restrict in net payment.
- Intensive plantation and natural even-aged system with minimal harvesting between rotation periods can accrue highest carbon revenues.
- Carbon payment program is sensitive to price and interest rate.
- Generally, lower interest rates with higher CO_2 prices favors the contract.

Conclusion

- Starting point should be as early as possible in even-aged and plantation regimes.
- Cutting cycle should be longer as possible.
- Uneven-aged management needs credit from CO_2 sequestered in LLWP otherwise it is least favored practice in carbon payment program.
- Additionality and buffer pool reduces the opportunity to add forest CO_2 especially when higher baseline is taken.

Acknowledgement

- Dr. Matthew H. Pelkki (Supervisor)
- Dr. Jamie Schuler
- Dr. Sayeed Mehmood
- Dr. Michael Kane

UAM
The University of Arkansas at Monticello

UofA
University of Arkansas
Division of Agriculture

Arkansas Forest Resources Center

1785
The University of Georgia

PMRC

Warnell
School of Forestry and Natural Resources
The University of Georgia


Questions
Comments
Thoughts
??